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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/786,187	02/25/2004	Ping-Hsu Chen	67,200-1070	3693

7590 10/19/2006

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EXAMINER

NOVACEK, CHRISTY L

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 10/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/786,187

Applicant(s)

CHEN ET AL.

Examiner

Christy L. Novacek

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 August 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3, 5, 8-11, 13, 16-19 and 21-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 5, 8-11, 13, 16-19 and 21-27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This office action is in response to the amendment filed August 3, 2006.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 2, 5, 9, 10, 13, 16, 17, 19 and 21-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art in view of Miller (US 20040099638).

Regarding claim 1, the admitted prior art recited in Applicant's specification describes a conventional integrated circuit structure including a substrate (12) with alignment marks (16), a transparent dielectric layer (14) covering the alignment marks and at least one opaque layer (18/22) overlaying the alignment marks (paragraphs 0002, 0010). The admitted prior art recites that it is conventional to re-expose the alignment marks through an upper surface of the substrate by using photolithography to etch away the opaque layer overlaying the alignment marks (paragraph 0011). The admitted prior art does not disclose using a focused ion beam to remove the overlaying opaque layer. Like the admitted prior art, Miller discloses a conventional integrated circuit structure including a substrate having alignment marks that are covered with various layers of opaque metallization (para. 0008-0010, 0026-0033). Miller teaches that uncovering the opaque metallization layers by photolithography, as is done in the admitted prior art, is **disadvantageous**, stating:

“This process of uncovering or cleaning the alignment marks is typically accomplished with additional photolithography steps. However, the additional mask and etch steps, plus the attendant cleaning and inspection steps, undesirably increase cycle time and process complexity. As shown in the table below, uncovering an alignment

mark using a traditional photolithography process can delay further processing of a wafer up to 8 hours, while uncovering an alignment mark using the present invention may only take a total of approximately 0.25 hours.” (para. 0026).

Miller teaches that, instead of using the conventional photolithography method to uncover the alignment marks, it is better to use a focused ion beam to obliterate the opaque metallization layers overlaying the alignment marks, because the focused ion beam method does not employ the numerous steps required by the photolithography method, thus uncovering the alignment marks can proceed at a much faster rate than was previously possible (para. 0026, 0033-0034). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the focused ion beam method of Miller to re-expose the alignment marks of the admitted prior art because Miller teaches that the focused ion beam method does not employ the numerous steps required by the photolithography method, thus uncovering the alignment marks can proceed at a much faster rate than was previously possible.

Regarding claims 2, 10 and 17, Miller discloses that the focused ion beam has a noble gas source (para. 0034).

Regarding claims 5, 13 and 19, Miller discloses that the focused ion beam has a noble gas source of argon (para. 0034).

Regarding claim 9, the admitted prior art recited in Applicant’s specification describes a conventional integrated circuit structure including a substrate (12) with alignment marks (16), at least one transparent dielectric layer (14) overlaying the alignment marks, and at least one opaque layer (18/22) overlaying the transparent dielectric layer (paragraphs 0002, 0010). The admitted prior art recites that it is conventional to re-expose the alignment marks through an upper surface of the substrate by using photolithography to etch away the opaque layer

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overlaying the alignment marks, leaving the transparent layer intact over the alignment marks (paragraph 0011). The admitted prior art does not disclose using a focused ion beam to remove the overlaying opaque layer. Like the admitted prior art, Miller discloses a conventional integrated circuit structure including a substrate having alignment marks that are covered with various layers of opaque metallization (para. 0008-0010, 0026-0033). Miller teaches that, instead of using the conventional photolithography method to uncover the alignment marks, it is better to use a focused ion beam to obliterate the opaque metallization layers overlaying the alignment marks, because the focused ion beam method does not employ the numerous steps required by the photolithography method, thus uncovering the alignment marks can proceed at a much faster rate than was previously possible (para. 0026, 0033-0034). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the focused ion beam method of Miller to re-expose the alignment marks of the admitted prior art because Miller teaches that the focused ion beam method does not employ the numerous steps required by the photolithography method, thus uncovering the alignment marks can proceed at a much faster rate than was previously possible.

Regarding claim 16, the admitted prior art recited in Applicant's specification describes a conventional integrated circuit structure including a substrate (12) with alignment marks (16), a transparent dielectric layer (14) overlaying the alignment marks, and at least one opaque layer (18/22) overlaying the transparent dielectric layer (paragraphs 0002, 0010). The admitted prior art recites that it is conventional to re-expose the alignment marks through an upper surface of the substrate by using photolithography to etch away the opaque layer overlaying the alignment marks, leaving the transparent layer intact over the alignment marks and viewing the alignment

marks through the exposure opening and the dielectric layer (paragraph 0011). The admitted prior art does not disclose using a focused ion beam to remove the overlaying opaque layer. Like the admitted prior art, Miller discloses a conventional integrated circuit structure including a substrate having alignment marks that are covered with various layers of opaque metallization (para. 0008-0010, 0026-0033). Miller teaches that, instead of using the conventional photolithography method to uncover the alignment marks, it is better to use a focused ion beam to obliterate the opaque metallization layers overlaying the alignment marks, because the focused ion beam method does not employ the numerous steps required by the photolithography method, thus uncovering the alignment marks can proceed at a much faster rate than was previously possible (para. 0026, 0033-0034). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the focused ion beam method of Miller to re-expose the alignment marks of the admitted prior art because Miller teaches that the focused ion beam method does not employ the numerous steps required by the photolithography method, thus uncovering the alignment marks can proceed at a much faster rate than was previously possible.

Regarding claims 21 and 27, the admitted prior art discloses that the transparent dielectric layer is left substantially intact (transparent dielectric layer is not etched or removed) covering the alignment marks following removal of the opaque layer (para. 0011).

Regarding claims 22, 24 and 26, the admitted prior art discloses that the transparent dielectric layer and the opaque layer are layers formed over the alignment marks during metal-insulator-metal (MIM) device fabrication (para. 0008-0009, 0011).

Regarding claims 23 and 25, the admitted prior art does not specifically disclose viewing the opaque layer removal. Miller teaches that the focused ion beam may be equipped with an

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optical microscope that allows a user to observe the removal of the opaque layer to ensure adequate removal of the layer (para. 0047). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the optical microscope of Miller to view the opaque layer removal in real time including view the transparent dielectric layer because Miller teaches that the optical microscope allows the user to confirm adequate removal of the opaque layer over the alignment marks.

Claims 3, 8, 11 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art in view of Miller (US 20040099638) as applied to claims 2, 5, 9, 13, 16 and 19 above, and further in view of Lee et al. (US 6,251,782, previously cited).

Regarding claims 3, 8, 11 and 18, Miller does not disclose using a current density of 200-800 pA to etch the opaque layer. Lee discloses that a FIB system having a current density of 672 pA can successfully etch through opaque material (col. 6, ln. 19-33). At the time of the invention, it would have been obvious to one of ordinary skill in the art to FIB etch the opaque layers of Miller using a current density of 672 pA because Lee teaches that a current density of 672 pA can successfully etch an opaque layer.

Response to Arguments

Applicant's arguments filed August 3, 2006 have been fully considered but they are not persuasive.

Regarding the rejections of claims 1, 9 and 16 as being unpatentable over the admitted prior art in view of Miller, Applicant argues that there is allegedly no motivation to combine the references. As stated above, Miller teaches that, instead of using the conventional

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photolithography method recited by the admitted prior art to uncover the alignment marks, it is better to use a focused ion beam to obliterate the opaque metallization layers overlaying the alignment marks, because the focused ion beam method does not employ the numerous steps required by the photolithography method, thus uncovering the alignment marks can proceed at a much faster rate than was previously possible (para. 0026, 0033-0034). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the focused ion beam method of Miller to re-expose the alignment marks of the admitted prior art because Miller teaches that the focused ion beam method does not employ the numerous steps required by the photolithography method, thus uncovering the alignment marks can proceed at a much faster rate than was previously possible.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

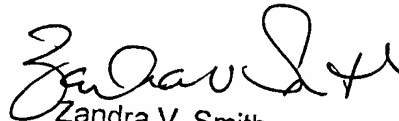
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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (571) 272-1839. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571) 272-2429. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLN
October 3, 2006


Zandra V. Smith
Supervisory Patent Examiner
16 Oct. 2006